mental triangle. Show that the Brocard triangle and the fundamental triangle are in perspective, and that the trilinear coördinates of the center of perspectivity are s_i^{-3} ($i = 1, 2, 3$) instead of s_i^3 which are incorrectly given in Clebsch's *Vorlesungen über Geometrie*, p. 323.

509. Proposed by NORMAN ANNING, Chilliwack, B. C.

A picture whose coördinates are (0, 0), (50, 0), (50, 50), and (0, 50) is repeated on a smaller scale as part of itself with the coördinates (7, 0), (31, 7), (24, 31), (0, 24). Locate the vanishing point.

CALCULUS.

423. Proposed by J. B. REYNOLDS, Lehigh University.

Show that the envelope of all circles with their centers on the circle $x^2 + y^2 = a^2$ and tangent to the x-axis is the two-arched epicycloid.

424. Proposed by OSCAR S. ADAMS, Washington, D. C.

What is the value of

$$\frac{\Gamma'(1)}{\Gamma(1)} - \frac{\Gamma'(\frac{1}{2})}{\Gamma(\frac{1}{2})}\,?$$

MECHANICS.

340. Proposed by PAUL CAPRON, U. S. Naval Academy.

A rigid straight line l passes through a fixed point O, but is otherwise free to move in a plane. If C is the instantaneous center of rotation for l, prove that CO is always perpendicular to l and that, if (O being used as pole) $\rho = f(\theta)$ represents the locus of any point P on l, OC is always equal to $(d/d\theta)f(\theta)$.

341. Proposed by PAUL CAPRON, U. S. Naval Academy.

A pole l feet long, with one end on the ground, touches the top of a wall a feet high and slides in a vertical plane perpendicular to the wall. Show that its instantaneous center of rotation is at the intersection of the vertical where it touches the ground with the perpendicular to its axis where it touches the wall, and that the locus of this center is a parabola having the latus rectum a.

NUMBER THEORY.

259. Proposed by E. E. WHITFORD, College of the City of New York.

If p is relatively prime to 10, and if any multiple of p consisting of n digits has its digits permuted cyclically, the number thus formed is also a multiple of p; the number n to be determined by the congruence $10^n \equiv 1 \pmod{p}$. For example, 481, 814, and 148 are each multiples of 37.

260. Proposed by ALBERT A. BENNETT, University of Texas.

Let $\binom{n}{r}$ denote as usual the binomial coefficient $n!/[r!(n-r)!]$, where $\binom{n}{0} = 1$, but where n, r, $(n-r)$ are always to be supposed to be positive integers or zero. Let us define $k_i(m, n)$ as $\sum_j \binom{m-i+j}{i-j}\binom{n-j}{j}$. Prove that the following recursion formulas are consistent:

$$\sum_i (-1)^i k_i(m, n) C_{m+n-i} = \binom{m+n}{m}$$

and determine $C_0 = 1$, $C_1 = 1$, $C_2 = 2$, $C_3 = 5$, $C_4 = 14$, $C_5 = 42$, $C_6 = 132$, $C_7 = 429$, $C_8 = 1{,}430$, etc. Prove also that these quantities satisfy the following relations, as well:

$$\sum_i (-1)^i C_{m-n-i} \binom{m-i}{i} = 0 \text{ for each } n \text{ where } 2n \leq m.$$